LIMITED ENERGY STUDY
EEAP - DACA01-94-D-0037

FOR

Fort Monmouth

US Army Corps
of Engineers

U.S. ARMY ENGINEER DISTRICT, NORFOLK
CORPS OF ENGINEERS
NORFOLK, VIRGINIA

FINAL REPORT

Book 1 of 2

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LIMITED ENERGY STUDY EEAP PROGRAM

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1.0 EXECUTIVE SUMMARY

1.1 Introduction

This report is a Limited Energy Study (Building 2700) for the Public Works Department at Fort Monmouth, Eatontown, New Jersey participating in the Energy Engineering Analysis Program (EEAP). This program supported by the U. S. Army Engineer District, Norfolk, is used to assist military installations in identifying energy usage and cost saving projects at their facilities and possibly provide funding for projects. Entech Engineering, Inc. was selected to perform this study.

1.2 Objectives

The objective of this contract is to address Building 2700's (Myer Center) Central Steam Boiler Plant and the HVAC systems in the building. The work associated with the boiler plant also entails limited study of Building's 2704, 2705, 2706, and 2715. Refer to the detailed statement of work and subsequent correspondence in Appendix 8.13, Book 2 of 2.

1.3 Report Organization

The report consists of two books, Book 1 contains the results of the site surveys, analysis, and project development. The following sections are contained within Book 1.

A. Section 2 - Methodology, describes in detail software and techniques used in the analysis.

B. Section 3 - Facility Description, contains tables summarizing building characteristics and components.

C. Section 4 - Building Histories, quantifies existing and historical energy costs for fuel oil, natural gas, and electricity.

D. Section 5 - Energy Calculations, contains calculation results of energy cost by building, systems, and components.

E. Section 6 - Energy Conservation Opportunities, presents analysis of energy saving projects.

F. Section 7 - Summary of ECO results.

Book 2 contains the Statement of Work and report backup data.

1.4 Facilities Description

Building 2700 is a large structure that encompasses approximately 700,000 gross square feet of floor area on four (4) floor levels, a partial basement floor level and a partial mezzanine level on the first floor. Activities within the building include research and development for electronics.

Building 2700 is supported by two boiler plants. The original central steam plant located in the basement also supports the buildings listed previously. Building 2706 located next to Building 2700 houses a new hot water boiler plant that supports a portion of the heating loads in Building 2700. An inventory of the buildings involved is shown in Table 1.4.1.

Building Inventory
Table 1.4.1

Building	Type	Floor (sf)
2700	Research & Development	700,000
2704	Research & Development	7,100
2705	Night Vision Lab	47,592
2706	Utility	5,000
2715	Storage	3,000

1.5 Energy Usage

The average energy usage in Building 2700 for 1994/1995 is shown in Table 1.5.1. The fuel costs for No. 6 Fuel Oil for 1994/1995 were $334,250. The estimated comparable natural gas costs for this period would have been $478,000. The electric costs for Building 2700 are estimated to be $1,444,000.

1994/1995 Average Energy Summary for Building 2700
Table 1.5.1

Energy	Energy Unit Total	mmBtu/ unit	Cost Total
No. 6 Fuel Oil ($0.69/gal)	484,420	67,670	$334,250
Natural Gas ($7.50/mcf) (see note)	63,720	65,695	$478,000
Electric Demand ($8.67/kW avg.)	38,389	131	$332,850
Electric Usage ($0.0682/kWh avg.)	16,290,145	55,600	$1,111,150

Note: Excluding the comparable costs for natural gas the total yearly energy costs for Building 2700 are estimated to be near $1,780,000.

1.6 Summary of ECO Results

The summary of results for the ECOs evaluated in this report are shown in Table 1.6.1

ECO Summary for For
Table 1.6.1

ECO #	ECO Description	Implementation Costs			
		Construction Cost	SIOH Cost	Design Cost	Total Cost
1	Steam Decentralization, Base Case	$1,199,000	$67,000	$73,000	$1,339,00
1A	New Steam Boilers in Building 2700				$
1B	New Hot Water Boilers for Cleanroom	$1,229,000	$69,000	$74,000	$1,372,00
1C	Operate Cleanrooms with MCA Hot Water				$
1D	Electric Domestic Hot Water Generator				$
1E	Decentralize Domestic Hot Water	$1,238,000	$69,000	$75,000	$1,382,00
2	Building 2700 MCA System ±5°F Temp. Setback Control	$46,200	$2,500	$2,800	$51,50
3	Reduce Building Infiltration	$86,000	$4,700	$5,300	$96,00
4	Replace Existing Central Chillers	$258,900	$14,000	$16,000	$288,90
5	Convert Specific Air Cooled Chillers to Water Cooled	$249,500	$14,000	$15,000	$278,50
6	Free Cooling	$80,400	$4,000	$5,000	$89,40
7	2-Speed Fan Operation	$26,600	$1,500	$1,600	$29,70
8	Replace DHW Recirculation Pumps				$
9	Automated MCA HW Temperature Reset	$12,500	$700	$800	$14,00
10	Full Chilled Water Storage	$800,000	$44,000	$48,000	$892,00
11	Partial Chilled Water Storage	$490,000	$27,000	$29,000	$546,00
12	Variable Flow Primary-Secondary Chilled Water Dist.	$158,700	$8,700	$9,500	$176,90

nmary for Fort Monmouth
Table 1.6.1

osts		Annual Savings						LCCID Payback	LCCID SIR
gn t	Total Cost	Gas mmBtu	Gas Cost	Electric mmBtu	Electric Cost	$/mmBtu	Recurring Maintenance		
)00	$1,339,000	36,685	$267,000	(67)	($1,089)	$16.25	$190,000	2.9	5.32
	$0								
)00	$1,372,000	37,525	$273,000	(119)	($2,989)	$25.12	$190,000	3.0	5.25
	$0								
	$0								
)00	$1,382,000	39,235	$285,510	(984)	($19,661)	$19.98	$170,000	3.2	5.00
00	$51,500	623	$4,500	1,887	$34,200	$18.12		1.3	10.7
00	$96,000	1,329	$9,700	(2)	$0	$0.00		9.9	1.7
00	$288,900			1,018	$25,066	$24.62		11.5	1.2
00	$278,500			274	$7,367	$26.89		37.8	0.4
00	$89,400			183	$4,408	$24.09		20.3	0.7
00	$29,700			141	$2,600	$18.44		11.4	1.2
	$0								
00	$14,000	351	$2,500					5.5	3.1
00	$892,000			420	$36,200	$86.19		24.6	0.6
00	$546,000			111	$14,900	$134.23		36.7	0.4
00	$176,900			474	$9,200	$19.41		19.2	0.7

1.7 Conclusion

The primary focus for this analysis was to determine the practicality of continued use of the central steam boiler plant in Building 2700. The findings reflect that with the new hot water boiler installation in Building 2706 supporting a large portion of Building 2700, the old centralized system is entirely too large and outdated to continue based on energy costs and maintenance and operation costs.

However, identifying cost effective Energy Conservation Opportunities associated with Building 2700's HVAC systems was limited. Two primary reasons were the part-time use of the central chiller system with the MCA 2-pipe heating and cooling system, and the large number of miscellaneous systems that support the remainder of this 700,000 square foot building.

In summary, only four (4) ECOs have been recommended for implementation out of the list identified in Table 1.6.1.

The ECOs were then categorized into one of the five types of projects. The five include:

1. Recommended ECIP
2. Recommended Non-ECIP O&M Projects
3. Recommended Non-ECIP LC/NC Projects
4. Recommended Non-ECIP General Projects
5. Non-feasible (listed as group in Section 7 only).

The criteria used to place the ECOs into these categories is detailed in Section 7. Of those, only one is considered to be eligible for ECIP designation.

That project ECO-1 (Base Case), decentralizes the central steam boiler plant by placing loads on the new hot water heating system, placing new boilers in areas/buildings that can not be supported by the hot water system, and provides new equipment for Building 2700's domestic hot water system, and where applicable in the cafeteria.

Recommend ECIP Projects
Table 1.7.1

ECO #	Description	Total Cost	Annual Energy Savings	Annual Maint. Savings	LCCID Payback	LCCID SIR	Energy Savings (mmBtu)
1	Steam Decentralization	$1,339,000	$265,911	$190,000	2.9	5.32	623 (Gas) 1,887 (Elec.)

Total Savings #455,911 2,510

The remaining three (3) recommended ECOs are Non-ECIP LC/NC (Low Cost/ No Cost) projects. All three have potential for savings, and improved control for the system/building operations. The three are listed below:

Recommend Non-ECIP LC/NC Projects
Table 1.7.2

ECO #	Description	Total Cost	Annual Energy Savings	Annual Maint. Savings	LCCID Payback	LCCID SIR	Energy Savings (mmBtu)
2	Bldg 2700 MCA System ±5° Temp. Setback Control	$51,500	$38,700	$0	1.3	10.70	36,685 (Gas) (67) (Elec.)
9	Automated MCA HW Temp. Reset	$14,000	$2,500	$0	5.5	3.10	351 (Gas)
3	Reduce Building Infiltration	$96,000	$9,700	$0	9.9	1.7	1,329 (Gas) (2) (Elec.)

Total # 50,900 38,296

Note: Refer to Section 2.6.6 for an explanation about the LCCID program.

455,911 + 50,900 = # 506,811

2,510 + 38,296 = 40,806 MBTU

The following is a suggested implementation approach for the recommended ECOs.

A. ECIP Project:

Budget $1.4 million for the steam centralization project (ECO-1). Budget additional funding as required to accommodate a specified amount of demolition of boiler plant equipment, piping, etc. Planning and scope development for the demolition work not required for project implementation has yet to be determined. The alternate selection of ECO-1 (Option B) would be made if hot water boilers are desired in lieu of steam for controlling Building 2700's cleanrooms.

B. Non-ECIP LC/NC Projects

Implement the Non-ECIP LC/NC Projects where possible. Details surrounding the implementation of ECO-3 (Infiltration Reduction) will require additional effort towards identifying a project scope and plan. That level of effort is beyond the limited energy study parameters. A detailed review of all the exhaust systems and their users would have to be completed before the implementation scope cost estimates and projected savings can be established for ECO-3. What we have presented here are the ECO figures to be considered prior to pursuing the project further as an energy saving opportunity.

On a final note, the decentralization of the central plant in Building 2700 not only will have significant savings, it should also improve the comfort and operations of the involved buildings and systems.